

VLBI2010 System Cost Estimates

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Several requests have been received for an estimate of the cost of a VLBI2010 system, where such a system can be obtained, and the period of production. At this point development of the prototype data acquisition system has not been completed, so only partial answers can be given, based on the progress to date and on projections from previous projects.

In spite of these uncertainties three groups have begun deployment of VLBI2010 systems. The budgets range from approximately 10 million euros (MEUR) for extremely high-quality twin antennas at one location to about 2 MEUR for a single-antenna site that meets the minimum requirements as outlined by the VLBI2010 Committee of the IVS.

Two excellent antennas which easily meet the geodetic requirements have been ordered by the German agency Bundesamt für Kartographie und Geodäsie (BKG). The 13m antennas are to be installed as a pair at one location in Wettzell, Germany. These antennas comfortably meet the slew rate requirements and are designed to be sufficiently robust to be able to observe continuously for twenty years. The cost for the pair is approximately 7 MEUR, which includes some development costs but does not include the receiver and data acquisition chain. An amount of 1.7 MEUR has been allocated for the receiver and data acquisition systems for the two antennas. Delivery time for the antenna order is approximately two years. An amount of 0.3 MEUR has been budgeted for infrastructure costs such as antenna pad, operations building, and utilities. Thus the total cost is approximately 9 MEUR. The contact for this project is Dr. Hayo Hase of the BKG (hase@udec.cl). He is willing to provide more information if requested.

While the German project does not need to purchase a Hydrogen maser, it is an essential component of the geodetic VLBI system. Because the required accuracy cannot be achieved without a maser, a backup maser is highly desirable. The second maser also serves to monitor the performance of the primary system. The cost of two commercially available masers is approximately 0.4 MEUR.

Superb VLBI2010 System

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| Two antennas | 7 MEUR |
| Receiver and data acquisition | 1.7 MEUR |
| Infrastructure costs | 0.3 MEUR |
| Masers | 0.4 MEUR |
| Total (with miscellaneous) | 10 MEUR |

The system described above is the model. However, other agencies have chosen to purchase only one antenna for each site and at lower cost and with less capability. The requirements for the masers and infrastructure are essentially the same for one or two antennas, but the receiver and data acquisition system cost is prorated. The approximate cost for such an installation is 2 MEUR. Although I do not have an exact value, this is in line with the projected cost of a similar installation under study by MIT Haystack Observatory for NASA.

Capable VLBI2010 System

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| One antennas | 0.4 MEUR |
| Receiver and data acquisition | 0.6 MEUR |
| Infrastructure costs | 0.3 MEUR |
| Masers | 0.4 MEUR |
| Total (with miscellaneous) | 2 MEUR |

Among the miscellaneous items that will be required are recording media and a high speed network connection. While the initial mode of data transfer will probably be shipping of disk modules, a network connection with a capacity of many Gigabits per second will be necessary for most installations.

The estimates do not include annual operating costs or maintenance since these are highly site specific. A goal for the VLBI2010 systems is fully automated operation, but minimal attendance by an operator/technician for module changes and routine maintenance will be required. These costs could be shared for those sites that have other instrumentation, such as a Satellite Laser Ranging system.

Another question is the availability of a VLBI2010 system. As indicated above, the antennas and masers are currently commercially available. There will be two modes of operation in the future: a mode compatible with the current dual frequency X/S systems, and the VLBI2010 mode which will be a four-band system recorded at a much higher data rate. For operation in X/S compatibility mode, at least one design of an antenna feed, digital backend, and data recorder are commercially available. However, receivers at X- and S-band must be fabricated that satisfy VLBI standards. For use with other VLBI2010 systems, only prototype feeds and receivers exist at this time. We would like to have a source for these components by sometime in 2010.